

**Notice of Allowability**

Application No.

10/790,404

Examiner

Suzanne Lo

Applicant(s)

HOLLAND, RICHARD ANDREW

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to Preliminary Amendment submitted 12/15/06.
2. ☒ The allowed claim(s) is/are 1-8 and 68-74.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some\* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),  
Paper No./Mail Date \_\_\_\_\_
4. ☐ Examiner's Comment Regarding Requirement for Deposit  
of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413),  
Paper No./Mail Date 12/12/06.
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other \_\_\_\_\_

  
**KAMINI SHAH**  
SUPERVISORY PATENT EXAMINER

### EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Livinia Jones on 12/21/06, 10:12 AM.

The application has been amended as follows:

Cancel claims 9-65 and 75.

2. This application is in condition for allowance except for the presence of claims 9-65 directed Groups II-VII non-elected without traverse. Accordingly, claim 9-65 been cancelled.

3. The Information Disclosure Statement submitted by Applicant on 05/04/06 has been amended to include the publication date, 1981, for the non-patent literature entry, page 2, of Lockwood et al., "A New Radiation Solution Method for Incorporation in General Combustion Prediction Procedures".

4. Claims 1-8 and 68-74 are allowed over the prior art of record.

5. The following is an examiner's statement of reasons for allowance:

Applicants are disclosing a method of algorithmically simulating the transportation of particles through a medium, comprising establishing a set of initial particle and environmental conditions, creating a computational grid system of voxels, initiating simulated transportation of particles, applying transport multipliers, compiling particle interaction tallies and computationally producing an output indicative of the simulated particle transport. This has been disclosed in the prior art of record.

The prior art of record does not disclose the method wherein the method steps include *establishing a plurality of ray sets* of particle distributions with a computational algorithm wherein a ray set are defined as a number of representative rays from 1 to n, where n is a finite integer; these rays represent the average relative fraction and voxel path length of all rays emanating from a surface or

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*volume, and traversing a grid; each ray within a ray set has a unique fraction and unique voxel path length; the ray traverses the same pathway through the voxel grid as other members of its set*

(Specification, [0023]), using said ray sets and appropriate integration kernel to determine *invariant imbedding transport multipliers or direct collision moment transport multipliers*, compiling the particle interaction tallies from within computer memory locations and applying the interaction model to determine scattering, state and accumulated interactions *over a time epoch or generation*, repeating method steps until interaction reaction rates and/or the generational *supercritical, critical or subcritical* Eigenvalue substantially converge.

The closest prior art uncovered during examination teaches certain limitations of the claimed invention as follows:

**U.S. Patent No. 6,714,620, Caflisch:** Discloses a method of algorithmically simulating the transportation of particles through a medium, comprising the steps: establishing a set of initial particle and environmental conditions (**column 7, lines 15-54 and column 27, lines 14-24**); creating a computational grid system of voxels from a physical object or system (**column 3, lines 36-40**); initiating the simulated transportation of particles by applying a plurality of discrete particle distributions within voxel interaction tallies and/or upon voxel tally surfaces (**column 18, lines 17-34**); applying the transport multipliers for transporting discrete particle tallies from the first plurality of voxels to a second plurality of voxels (**column 27, lines 14-24**); continuing the particle tallies in voxels as the sets of particle distributions sequentially transport through the grid system of voxels until a predetermined limit is attained (**column 18, lines 24-34**); and computationally producing an output indicative of the simulated particle transport (**column 27, lines 43-47**). However, Caflisch does not disclose establishing a plurality of ray sets of particle distributions with a computational algorithm; using said ray sets and appropriate integration kernel to determine invariant imbedding transport multipliers or direct collision moment transport multipliers; compiling the particle interaction tallies from within computer memory locations and

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applying the interaction model to determine scattering, state and accumulated interactions over a time epoch or generation; repeating method steps until interaction reaction rates and/or the generational supercritical, critical or subcritical Eigenvalue substantially converge.

U.S. Patent No. 6,335,792 B1, Tsuchiya: Teaches particle transport by calculating weight functions and coefficients (**column 4, lines 18-24**) as well as particle path distribution (**column 5, lines 36-41**) but with the Monte Carlo method (**column 11, lines 18-24**) instead of invariant imbedding or direct computationally. Tsuchiya also does not teach ray sets and time epoch/generation accumulation.

U.S. Patent No. 6,148,272, Bergstrom et al.: Teaches particle transport by calculating dosage volumes (**column 5, lines 56-67**) and generating voxels (**column 5, lines 38-41**) but with the Monte Carlo method (**column 14, line 60 - column 15, line 21**) instead of direct computationally or with invariant imbedding and ray sets.

**“Invariant Imbedding and the Calculation of Eigenvalues for Sturm-Liouville Systems”**, Scott et al.: Teaches invariant imbedding with eigenvalue convergence for boundary problems (**page 22, “Conclusions”, 1<sup>st</sup> paragraph**) but fails to teach any application towards particle transport, as well as ray sets and time epoch accumulation.

Furthermore, the prior art of record does not meet the conditions as suggested in MPEP section 2132, namely:

“The identical invention must be shown in as complete detail as is contained in the ... claim.” Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the claim, but this is not an **ipsissimis verbis** test, i.e., identity of terminology is not required. **In re Bond**, 910 F.2d 831, 15 USPQ2d 1566 (Fed. Cir. 1990).”

In particular, the **prior art of record does not disclose the specific sequence of method steps inclusive of a direct computational method of algorithmically simulation the transportation of particles through a medium comprising the steps of a) establishing a set of initial particle and environmental**

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conditions; b) creating a computational grid system of voxels from a physical object or system; c) establishing a plurality of ray sets of particle distribution with a computational algorithm; d) using said ray sets and appropriate integration kernel to determine invariant imbedding transport multipliers or direct collision moment transport multipliers; e) initiating the simulated transportation of particles by applying a plurality of discrete particle distributions within voxel interaction tallies and/or upon voxel tally surfaces; f) applying the transport multipliers for transporting discrete particle tallies from the first plurality of voxels to a second plurality of voxels; g) continuing the particle tallies in voxels as the ray sets of particle distributions sequentially transport through the grid system of voxels until a predetermined limit is attained; h) compiling the particle interaction tallies from within computer memory locations and applying the interaction model to determine scattering, state and accumulated interactions over a time epoch or generation; i) repeating steps (f-h) until interaction reaction rates and/or the generational supercritical, critical or subcritical Eigenvalue substantially converge, and j) computationally producing an output indicative of the simulated particle transport.

Likewise, claims 2, 68, and 69 also include the specific sequence method steps not disclosed by the prior art for the same reasons as noted above and therefore render claims 2, 68, and 69 non-obvious over the prior art of record.

### **Response to Arguments**

6. The 35 U.S.C. 101 and 112, 2<sup>nd</sup> paragraph rejections of the previous office action mailed 10/04/06 have been withdrawn.

### **Conclusion**

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

1. U.S. Patent No. 6,175,761 B1 issued to Frandsen et al. on 01/16/01.

2. U.S. Patent No. 6,301,329 B1 issued to Surridge on 10/09/01.
3. U.S. Patent No. 6,029,079 issued to Cox et al. on 02/22/00.
4. U.S. Patent Application Publication 2003/0204126 A1 published by Rivard on 10/30/03.
5. "Random Walk, Scattering, and Invariant Imbedding I. One-Dimensional Discrete Case"  
published by Bellman et al. on 10/15/57.
6. "Dissipation Functions and Invariant Imbedding" published by Bellman et al. on 08/15/60.
7. "Invariant Imbedding and the Reduction of Two-Point Boundary Value Problems to Initial  
Value Problems" published by Bellman et al. on 10/25/60.

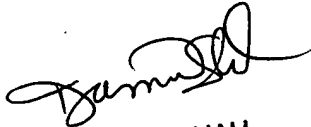
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Suzanne Lo whose telephone number is (571)272-5876. The examiner can normally be reached on M-F, 8-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571)272-2297. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Suzanne Lo  
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SL  
12/21/06

  
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